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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/945,507	08/30/2001	Leonard Forbes	1303.014US1	2649

7590 06/17/2003  
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EXAMINER

DINH, SON T

ART UNIT PAPER NUMBER

2824

DATE MAILED: 06/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/945,507

Applicant(s)

FORBES ET AL.

Examiner

son t dinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-80 is/are pending in the application.
- 4a) Of the above claim(s) 24-80 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4,6,8-11,13,14,17,19 and 23 is/are rejected.
- 7) ☒ Claim(s) 5,7,12,15,16,18 and 20-22 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: *East search history*.

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### **DETAILED ACTION**

The election filed on 3/31/03 has been entered.

Claims 1-80 are pending in the application.

The election of claims 1-23 has been acknowledged.

Claims 24-80 are withdrawn from consideration in view of the election.

### ***Claim Objections***

Claim 17 is objected to because of the following informalities: "the metal layer" (line 7) should be changed to --the first metal layer--. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1,2, 3, 6, 9,10,11,13-14, 17,19, 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Nakazato et al (U.S. Patent No 5,952,692).

For the purpose of this rejection, the storage node which is located between a control gate and a channel (the region between source and drain) in a vertical direction would be considered as a floating gate.

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Regarding claims 1, 3, 9, 11 and 17, Nakazato et al disclose a memory device comprising a first source/drain region (6, figure 5) formed on a substrate (3, fig.5), a body region including a channel region (the region between 6 and 7 in figure 5), a second source/drain region (7, fig. 5), a floating gate (1, fig. 5) opposing to the channel region, a control gate (9, figure 5) opposing to the floating gate 1, wherein the control gate 9 and the floating gate 1 is separated by a tunnel barrier (2, figure 5). As of claims 11 and 17, the bottom metal layer of element 2 (figure 13) would be a first metal layer, the top metal layer of element 2 (figure 13) would be a second metal layer. Also, column 12, lines 66-67 discloses that their tunnel barrier includes a transition of metal oxide as claimed in claims 3.

Regarding claim 2, 10, 19, column 12, lines 49-53 shows that the tunnel barrier could be made by aluminum oxide ( $\text{Al}_2\text{O}_3$ ).

Regarding claim 6, figures 10 and 13 of Nakazato et al disclose a polysilicon floating gate (1, figures 10 and 13) having a metal layer (28, figure 13) formed thereon in contact with the low tunnel barrier insulator.

Regarding claim 13, 14, 23, the floating gate 1 (figure 5) is a vertical floating gate formed alongside of the body region 3 (figure 5), and the control gate 9 (figure 5) is a vertical control gate formed alongside of the vertical floating gate 1 (figure 5).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 4, 9-10 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim et al (U.S. Patent No 6,475,857).

Regarding claims 1 and 9, Kim et al (figures 2, 5B and 8B) disclose a floating gate transistor comprising first and second source/drain regions (42, figure 5B), a floating gate (12, figures 2 and 5B), a control gate (71, figure 8B), wherein the control gate and the floating gate is separated by a tunnel barrier (13, figure 2).

With respect to claims 4 and 10, column 9, lines 26, teaches that the tunnel barrier is selected from zirconium oxide (ZrO<sub>2</sub>).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakazano et al .

Nakazano et al applied as above. The only difference between Nakazano et al and claim 8 is Nakazano et al memory device is a p-channel type floating gate transistor. However, the selection between p-channel type or n-channel type just

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represent a choice that depends on a device fabrication process, and the operation of both are the same (in storing data). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nakazano et al by using a n-channel type floating gate transistor as a memory device since the P-channel type and N-channel type are functional equivalent.

***Allowable Subject Matter***

Claims 5, 7, 12, 15-16, 18, 20-22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 5, the prior art of record fail to disclose the use of a Perovskite oxide integrate insulator that is located between a control gate and a floating gate in a floating gate transistor.

Regarding claims 7, 12, the prior art of record fail to teach or suggest a floating gate transistor having a control gate that includes a polysilicon control gate having a metal layer formed thereon in contact with a tunnel barrier integrate insulator.

Regarding claim 15, the prior art of record fail to disclose a memory device including a control gate, a floating gate, a low tunnel barrier located between the control gate and the floating gate, wherein the floating gate includes a horizontally oriented floating gate formed alongside of a body region.

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Regarding claims 18 and 20, the prior art of record fail to disclose memory device comprising first and second source/drain region, a floating gate transistor, a control gate, a first metal layer formed on the floating gate, a metal oxide integrate insulator formed on the first metal layer, and a second metal layer formed on the metal oxide integrate insulator, wherein the first and second metal layers are lead and the metal oxide integrate insulator is lead oxide (as claimed in claim 18), and wherein the first and second metal layers include transition metal layers and the metal oxide intergate insulator includes a transition metal oxide integrate insulator (as claimed in claim 20).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Son t Dinh whose telephone number is 703-308-4120. The examiner can normally be reached on 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on 703-308-2816. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7724 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

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S. Dinh

June 12, 2003

A handwritten signature in black ink, appearing to read 'Son T. Dinh', with a stylized, cursive script.

**Son T. Dinh**  
Primary Examiner